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THE CONDITIONS AFFECTING THE
DEVELOPMENT OF FLAGELLATED ORGANISMS
FROM LEISHMAN BODIES AND THEIR BEARING
ON THE PROBABLE MODE OF INFECTION.

Leonard ROGERS

The Lancet, 1905, i.



a. Leishman body, showing the nucleus and the flagellum. b. Leishman body, showing the nucleus and the flagellum. c. Leishman body, showing the nucleus and the flagellum. d. Leishman body, showing the nucleus and the flagellum.



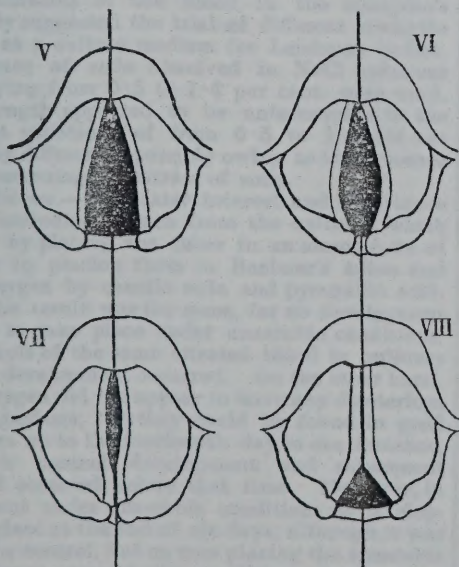
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the side-to-side compression produces a characteristic "scabbard-shaped" contraction.

A totally different class of laryngeal palsies is that which affects the phonatory function—*adductor paralysis*. This is nearly always bilateral and is not due to organic disease of the nerve path but either to a neurosis—the so-called "functional aphonia"—or to local disease, such as laryngitis, directly interfering with the action of the muscles. Functional aphonia is a common manifestation of hysteria but it should be clearly borne in mind that many cases, probably even the majority, are not purely hysterical. Anything which makes the effort of phonation greater than usual—constitutional debility, thickening of the cords, or laryngeal catarrh—predisposes strongly to this affection, which is characteristic rather of debility than of hysteria. It occurs in men as well as in women, though much less frequently, and I see a large number of such cases among consumptives at the Mount Vernon Hospital. In purely hysterical cases the cough is usually not aphonic; the onset is sudden, as also is the recovery, for many cases regain the use of the voice, as it were miraculously, on the application of the faradic current or a strong astringent.

Paralysis is very seldom complete, usually amounting only to an imperfect apposition of the cords; unilateral adductor paralysis is extremely rare; it is due to local interference with the muscles and in a few cases to toxic causes. The three sets of adductors may be all affected, or the arytenoideus may escape, or the thyro-arytenoidei may be affected alone. The arytenoideus may, though rarely, be paralysed alone from hysteria or catarrh; this gives rise to a very peculiar appearance, a triangular chink being left at the posterior part of the glottis. Adductor paralysis may be mistaken for complete bilateral recurrent paralysis, as the cords do not come to the middle line on attempted phonation; attention must be directed to the action on deep inspiration, for in recurrent paralysis the cords will not move, but in incomplete adductor paralysis they will now move further outwards; in complete adductor paralysis there is no difficulty, for the cords are extremely abducted well away from the cadaveric position of recurrent paralysis. These adductor palsies thus form a marked contrast to the group of abductor palsies; they produce a prominent symptom, aphonia, which attracts early attention, they are

FIG. 3.



V., Adductor paresis; all the adductors affected; phonation.
VI., Adductor paresis; arytenoideus unaffected; phonation.
VII., Paralysis of the thyro-arytenoidei; phonation. VIII., Paralysis of the arytenoideus; phonation.

not due to serious organic disease and they are not in themselves dangerous to life.

In conclusion, I would again remark that in a knowledge of the appearance and of the causes of laryngeal paralyses we have an important aid to diagnosis in many obscure cases, an aid which the practitioner can by no means afford to neglect.

THE CONDITIONS AFFECTING THE DEVELOPMENT OF FLAGELLATED ORGANISMS FROM LEISHMAN BODIES AND THEIR BEARING ON THE PROBABLE MODE OF INFECTION.

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IN THE LANCET of July 23rd, 1904, p. 215, I first described the development of flagellated organisms from Leishman bodies, and in the November number of the *Quarterly Journal of Microscopical Science* I described and illustrated the changes more fully, tracing the development day by day, flagellated forms being only found, as a rule, after three or four days. In one case, however, fully developed forms were found in 24 hours and these appeared to be more like trypanosomes than those which appeared on later dates in the other cultures. This suggested that in the case of the more rapid growth the conditions must in some way have been unusually favourable and led me to carry out a very long series of experiments to determine the optimum conditions for the development in the hope that if found they would throw light on the probable mode of infection of the diseases caused by this parasite. For many months no progress other than that of a negative nature resulted, but recently an important advance has been made which appears to me to indicate strongly the direction in which the solution will be found of the difficult question of the manner in which the infection of the disease is conveyed from one person to another. I propose in the present paper briefly to record the general results of my attempts to cultivate the parasite under different conditions and then to discuss the bearing of these on the probable mode of infection of the disease.

My observations on the development of the flagellated forms have been already confirmed by my assistant, Dr. G. C. Chatterjee, Lieutenant S. R. Christophers, I.M.S., and by Major W. B. Leishman, R.A.M.C., and Captain C. J. B. Statham, R.A.M.C., and I have very little to add to the descriptions I have already published except some minor details. In the first place I should have mentioned the very marked vacuolation which is present from the first enlargement of the organisms up to the flagellated stage in varying degrees, being most marked in large and broad forms, and least in the longest, thin, and most completely developed ones. Another interesting point which I noted early in the inquiry, but the full significance of which was only gradually worked out, is a well-marked eosin-staining body of a round or oval shape, which usually appears on the second day, and is commonly situated between the macro- and micro-nucleus. When the stage of elongation is reached it travels up to what will become the anterior or flagellated end of the now pyriform double body and carries with it the micronucleus. When the flagella first appear they are seen as short processes projecting from these eosin bodies, and at this stage they cannot as a rule be traced to the position of the micronuclei. In the later stages, especially in the separate completely developed long flagellate forms, this body is absent, while in nearly complete stages I have frequently seen it either partly or completely extruded from the organism, and then the flagella can be traced close up to the micronucleus. It is possible that this extrusion may have been due to pressure in preparing the film, but I am inclined to think that it is a part of the developmental process, although I am unable to explain its significance. This eosin-staining body has been independently described by Major Lenehan, whose term "flagella body" appears to be a good one. A more marked feature of my long experience is the uncertainty of the development of fully flagellated forms being obtained in the cultures in citrated blood, although the earlier stages are nearly always seen. Success depends very largely on the number of parasites found in the spleen blood preparations used, only those in which they are numerous, which form a small proportion of the whole, as a rule giving good results. This is especially the case when the parasites

are large and fat, the small shrunken ones, commonly met with in very chronic cases of the disease with very large hard spleen, seldom developing at all well. Again, if any micro-organisms are present and multiply rapidly the protozoal parasites degenerate and disappear. This applies especially to the presence of cocci, which are commonly found in the spleen and rarely even in the peripheral blood during the latter stages of the disease, and especially when cancerum oris is present, owing to an invasion of the system due to diminished phagocytic power of the blood, as I have several times demonstrated. On account of these various reasons I have only obtained fully developed flagellate forms in ten out of 60 attempts at culture in citrated bloods. Another marked feature is that in most of the successful cases the number of flagellated forms has been very small in proportion to the total number of the original and partly developed parasites present, multiplication of the smaller forms being a more marked feature than the pairing and elongation into flagellated forms, so that it is often necessary to examine several films carefully to find any of the latter. It is evident from this that the citrated blood is more suitable to the simple multiplication of the organisms than to their ultimate development into flagellated organisms.

The facts just recorded led me to believe that citrated blood was not the optimum condition for the flagellation of the parasites, so repeated endeavours were made to discover a more favourable medium in the hope that it would furnish a clue to the natural conditions under which the organism exists outside the human body. The results obtained so far may be briefly summarised under the following heads.

Citrated spleen blood added to sterile distilled water.—Several experiments have been made by this method but no development has ever been obtained, although in controls of the same spleen bloods in citrated normal salt solution development has been traced. As a rule the organisms disappear in three or four days in sterile water, but in one case small undeveloped forms were found as late as the ninth day, a very large number having been originally added. If, however, the water is not sterile and bacilli or cocci develop the protozoal parasites rapidly die out. As they are not likely to find their way into sterile water in nature it does not appear at all probable that water is the medium in which they live outside the human body, although they might survive long enough in it to be swallowed by some form of animal life.

Different strengths of salt solution.—The fact that flagellation of malarial parasites was found by Ross to be brought about by concentration of the blood in the mosquito's stomach naturally suggested the trial of different strengths of salt solution as a culture medium for Leishman bodies. 5 per cent. citrate of soda dissolved in NaCl solutions of strengths varying from 0.5 to 1.4 per cent. were used. The greatest strength appeared to be unfavourable to the development, but variations of from 0.5 to 1.1 did not seem to make any difference, possibly owing to the presence of such a large percentage of citrate of soda.

Anaerobic conditions.—Of greater interest and importance is the effect of excluding oxygen from the cultures, which was done either by placing the tubes in an atmosphere of hydrogen gas or by placing them in Buchner's tubes and absorbing the oxygen by caustic soda and pyrogallous acid. In either case the result was the same, for no development was ever found to take place under anaerobic conditions, although in controls of the same citrated blood in ordinary atmosphere good development occurred. On the other hand, the absence of oxygen did not appear to have any deleterious effect on the organisms, for they could be found in good staining condition up to the fourteenth day in one instance, although in the control development and subsequent degeneration had occurred before that time. Moreover, in another experiment under anaerobic conditions no development had taken place at the end of six days, although it was well marked in the control, but on now placing the anaerobic tube under ordinary atmospheric conditions development commenced and proceeded to a considerable degree. In another case in an acidified citrated blood no development took place in three days anaerobically, but on admitting the atmospheric oxygen very rapid and complete development in two days occurred, unusually long flagellated forms being obtained. It is clear from these experiments that anaerobic conditions while hostile to the development do not destroy the vitality of the organism.

In oxygen.—If the natural habitat of the organism outside the human body is in the circulating blood of some other form

of animal life, then it would appear to be probable that the bottom of a test-tube containing citrated blood and covered with half an inch or more of fluid would not contain sufficient oxygen for the full development of the organism. In order to test this the supernatant fluid has been removed after the spleen blood has settled down and the tubes placed nearly horizontally to allow as much aeration as possible but no improved development was obtained in this way. Further, a number of cultures have been made by placing the citrated blood tubes in a bell jar and passing a current of oxygen through until the emergent current lit a glowing piece of wood. The results again have been negative, no difference in the rate or degree of development having been noted in these tubes as compared with the controls. It would appear from this that the abundant supply of oxygen, such as is present in circulating blood, is not specially favourable to the development of the flagellated form of the organism.

In acidified citrated blood.—The above attempts to find the optimum conditions of development having all proved unsuccessful I next turned my attention to the conditions obtaining in the stomachs of biting insects, and especially of bugs, the latter in particular appearing to me to be specially likely carriers of the disease, for the reasons to be given presently. On adding fresh blood to the stomach contents of bugs which had fed on blood within a day or two I found that no immediate crenation or dissolution occurred, so that the amount of salts present did not appear to differ widely from that of human blood. The contents of their stomachs, however, consisted of a grumous material, staining of a reddish-brown colour with Romanosky's method, and in most of the insects examined the red corpuscles had lost their shape and been broken up. The reaction was markedly acid, and this observation led me to try neutralising and acidifying my citrated salt solutions either before or after adding the spleen blood containing the parasites to the culture tubes. On adding weak hydrochloric acid to render the citrate solution slightly acid and re-sterilising by heat I found the solution had again become alkaline owing to some chemical decomposition. The use of citric acid got over this difficulty. On using such an acidified medium controlled by another culture of the same blood in the ordinary alkaline citrate solution (which I found has a somewhat greater degree of alkalinity than that of the human blood) very different results were obtained. Thus in the first attempt as much development took place in the acidified solution in 12 hours as is usually found in a successful culture in the alkaline medium after two days. At the end of 24 hours, however, I was disappointed to find that the development had not continued at the same rate which was discovered to be due to the solution having again become alkaline. On acidifying once more with citric acid development proceeded well and on the third day flagellated organisms were obtained and on the following day were numerous. In a control in alkaline solution only a very slight degree of development occurred—namely, slight enlargement—but no double elongated or flagellated forms appeared. In a third tube of the same spleen blood which was just neutralised the earlier stages of development only took place, while in a fourth tube which was acidified and placed in oxygen good development with the formation of flagellated bodies took place, although they were less numerous than in the acid tube in ordinary air, no advantage having been obtained from the excess of oxygen. In a third experiment portions of the same spleen blood were placed in three tubes of citrated normal salt solution. The first was allowed to remain alkaline, as in all the former cultures, and no development at all occurred, the number of parasites originally present having been small. The second was just faintly acidified with citric acid and no development occurred in this either. The third was distinctly acidified by adding twice as many drops of normal citric acid as was required to just neutralise the second tube and the tube was placed under anaerobic conditions. No development whatever took place by the end of the third day. On now placing the tube in the air very marked development of elongated pairs, some with commencing flagella, was noted on the following day and one day later very numerous fully elongated narrow flagellated forms were seen, some in pairs and some already separated. In fact, these forms very closely resembled the exceptionally long and complete forms which developed in my first successful cultures in 24 hours and which I had been striving to obtain again for the last nine months. It now appeared to be clear that the acid medium was far more favourable for

the development than the alkaline one, for in three successive cases it had given very good results while the control alkaline cultures showed little or no development under otherwise similar conditions. That the acid medium is very favourable to the development of the flagellated forms as opposed to simple division and multiplication of the small oval spleen form of the parasites is confirmed by another very marked feature of these acid cultures. It has already been mentioned that in the alkaline medium rapid multiplication of the small forms is a more marked feature than the development of flagellated organisms and that when the latter are found in small numbers very much more numerous undeveloped and partly developed forms will be present, including many of the smallest size. On the other hand, in the acid medium when the elongated pairs and flagellate forms have appeared the small oval forms are either very few in numbers or even absent altogether. This striking fact strongly indicates the acid medium to be the optimum for the flagellation of the parasite and also points to the acid-containing contents of the stomachs of some blood-sucking insect as the place in which the parasite undergoes the extra-corporeal stage of its existence. Such an acid medium is also unfavourable to the growth of bacteria, which I have shown are very inimical to the protozoal parasites under consideration. As a matter of fact, I have found the stomach contents of bugs to be, as a rule, sterile and free from bacteria, although they may be occasionally present in large numbers. Further, on two occasions I have mixed the contents of the stomach of bugs, which had recently fed, with spleen blood containing the parasites, a portion of the former having been microscopically examined to exclude the previous presence of the parasites. No development has yet been obtained in this way but it has been found that the parasites remained in good staining condition for several days under these conditions, while as the controls did not develop in alkaline citrated blood and in one case but very few parasites were present the absence of development is not surprising. The experiments at least show that the conditions are not inimical to the continued life of the parasites, but that is all that can be said at the present time.

The above facts taken as a whole strongly indicate that the stomach of some blood-sucking insect is the most likely place in which to find the natural development of the extra-corporeal stage of the parasite and that some such insect is the most likely carrier of the infection.

The nature of the parasite.—The exact nature of the flagellated organisms which I have obtained from Leishman bodies is still uncertain. On the one hand, in favour of their being stages of a trypanosoma are the facts that they so closely resemble the various forms of trypanosoma Brucei described by Rose Bradford and Plimmer, to which may be added the fact that most of the forms obtained by Dr. Thiroux in cultures of the trypanosoma Paddæ, which are figured in the *Annales of the Pasteur Institute* of February, 1905, resemble very closely in appearance forms which I have obtained in my cultures. On the other hand, the failure of all observers to find any trace of an undulating membrane as yet is against this view and points rather to the organism being of the nature of a hepatomonas, but I observe in the figures in S. Prowazek's paper on the Hepatomonas in the *Arbeiten aus dem Kaiserlichen Gesundheitsamte* that he repeatedly figures a double flagellum arising from a single micronucleus, a condition which I have never seen in any of my numerous specimens. It can only be said at present that there is nothing known incompatible with the organisms being stages of a trypanosome but proof that it is so is still incomplete and it may possibly prove to be some other form of flagellate when the forms naturally developed outside its human host are discovered.

The probable mode of infection in kala-azar and cachexial fever.—In 1897 in my report on the Assam epidemic fever kala-azar I recorded a large amount of evidence to show that the mode of communication of the disease was essentially a house infection. Thus, when tracing the spread from village to village it was nearly invariably found that someone with the fever had gone to reside in a previously uninfected village and that the next cases occurred in the household in which he lived. Further, in the rare cases among Europeans some native employé in the house had suffered from the fever before the residents were attacked. Since that time I have obtained from various sources several most instructive histories bearing on this point, which it is very necessary

to record in order that the danger of infection may be avoided in the future. It is not essential to give in detail all the histories of which I have notes as they are only too similar to each other. It will suffice to say that in three cases in which there was much kala-azar in the coolie lines the infected Europeans either frequently had coolie women brought to their bungalows at night or visited them in their own lines. In three more cases the Europeans each cohabited with a native woman, each of whom was actually suffering from kala-azar and in two of these cases the women were known to have eventually died from the disease. What is still more conclusive is the fact that in two of these latter cases there was no other source of infection within several miles, as the coolie lines at these places were quite free from kala-azar at the time. The importance of recognising and avoiding such a source of infection is my reason for recording these undoubted facts. One other point must be referred to in this connexion—namely, that the moving of all the healthy people out of infected lines during the cold season, when I found new cases to be at a minimum, has proved a complete preventive of the disease as long as no infected people are admitted to the healthy lines. The line first moved at my suggestion over eight years ago has remained quite free from the disease to the present day and that, too, in spite of the fact that it is situated only half a mile away from the old infected one which has now been almost depopulated by kala-azar. It will be noted that this distance is not absolutely beyond the range of mosquito flight.

The above data refer to the Assam epidemic form of the disease but I have also some facts pointing to a similar house infection applying to the endemic form of the disease in Bengal which I have named "cachexial fever." During the last year I have been able to examine all cases of this disease admitted to the European General Hospital of Calcutta and have been much struck with the frequency with which more than one member of the same family have been admitted for cachexial fever at or about the same time. Thus within this period examples of father and child, mother and child, and several instances of two children of the same family being simultaneously affected have been met with among Europeans. All these facts bear out my original contention that the disease is a communicable one and that it is usually necessary to live for a time at least in the same house with an infected person in order to contract the disease. Further it appears probable in the light of the above facts that sleeping in the same bed is especially likely to lead to contraction of the disease, for this would account for its spread among children of the poorer European and Eurasian classes as well as in the Assam cases referred to above.

When we consider the above facts in view of my experiments proving that an acid medium is best suited to the development of the flagellated forms of the parasite and remember that such an acid medium is supplied in the stomachs of many blood-sucking insects, then we are forced to the conclusion that the most likely mode of infection is through the means of some such biting insect. But as to the most likely kind of insects to carry the infection we are on more uncertain ground, for experiment alone can determine this. Nevertheless, it is worth while to discuss which are the most probable kinds in order that precautions may be taken against them without waiting for absolute proof to be obtained. The choice will obviously depend on what we believe to be the most frequent avenue of escape from the body for the parasites. Major C. Donovan, I.M.S., describes forms with a single chromatin body as occurring in the peripheral blood, but in his coloured plate published in THE LANCET,¹ and from his descriptions I have been unable to see how he distinguishes these from ring-shaped malarial parasites which they so closely resemble. No other observer appears to have been able to find any such form in the peripheral blood. I have repeatedly taken several cubic centimetres of blood from a vein during high fever, both by day and at night, in cases in which the parasites had been found in large numbers in the spleen by puncture and after separating the bulk of the red corpuscles rapidly with the centrifuge have again centrifuged the fluid part of the blood. In this way very numerous blood plates can be found in the second sediment and any Leishman bodies would be found with them, but even by this method I have failed to find any parasites in the peripheral blood so they clearly cannot exist there in any numbers unless, indeed, they are present

¹ THE LANCET, Sept. 10th, 1904, p. 744.

in a particularly minute form. On the other hand, Lieutenant Christophers has shown that the parasites are frequently to be found in papules in the skin, especially on the thighs and other parts usually protected by the clothes from mosquitoes but still open to the attacks of fleas and of the still more blood-thirsty bugs. That the stomachs of the latter are well adapted for the development of the parasites I have indicated above, and although so far I have failed to find the parasites in bugs from the beds of patients suffering from cachexial fever in Calcutta and from kala-azar in Assam (the latter having been kindly supplied me by my friend Mr. J. Dodds Price, although they could not be examined until after a four days' journey), still I am of the opinion that bugs are the most likely carriers of the disease. That they abound in the wooden beds of natives, especially in Bengal and Assam, is quite certain, while they are also a pest in the poorer native and Eurasian houses and even in native hospitals. Further work to test this hypothesis is very necessary, but I venture to think that the probability of the bug or flea being the usual carriers of the disease is sufficiently great to render it advisable to take steps to prevent the possibility of infection being carried in this way. This may be done by recognising the communicability of even the endemic cachexial fever and preventing any infected and uninfected persons sleeping in the same bed or in adjoining beds placed close together, as is such a common custom in India. This precaution is specially desirable in the case of children who are very susceptible to the disease and in whom it is also exceptionally fatal, children under ten years in particular but seldom recovering from it.

In conclusion, I desire to express my thanks to Lieutenant-Colonel Harris and Lieutenant-Colonel Drury, I.M.S., for their very kind permission to make use of their cases and to Captain D. McCay, I.M.S., and Captain J. W. D. Megaw, I.M.S., for much help in examining cultures and for many valuable suggestions.

Calcutta.

A CASE OF WIDESPREAD ULCERATION OF SKIN AND CONNECTIVE TISSUE.

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In this paper it is proposed to give some short notice of a case of ulceration of skin and connective tissue which has recently come under my observation. The patient was a man, aged 61 years, employed in business, and came under my care in August, 1904. But for a somewhat severe attack of influenza 16 years and of pleurisy six years previously, he described himself as having been a healthy man up to the onset of the skin affection shortly to be described. He had never had syphilis and there was no family history of tubercle.

With regard to the skin affection, the patient gave the following history. In 1900 he noticed a small lump in the left buttock which slowly and painlessly increased in size and was followed in March, 1901, by a second lump which developed a little higher and nearer to the spine. Both of these ultimately burst. Shortly afterwards lumps began to form in the left groin and in August, 1901, recourse was had to surgical treatment, the lumps in the back and a number of enlarged glands from the groin being removed and the parts scraped by the late Mr. T. R. Jessop of Leeds. The result of this treatment was not satisfactory and ten weeks later the scraping was repeated. After a few months these places healed, but coincident with the improvement in these situations the disease showed itself in other localities. The course from now onwards was a progressively downward one. The skin gave way in a number of places at the back of the right chest and in the loins; early in 1902 he had considerable pain in the right shoulder and arm which was followed by inflammation of skin which broke down in numerous places and formed running sores. The same process commenced in the skin of the right leg in April, 1903, and the left leg became involved in the latter part of the same year. From 1902 he had been compelled to lead a life of invalidism, could walk only with difficulty, and had considerable pain. His general health suffered

consequence and the body weight fell from 11 stones 7 pounds in 1900 to 9 stones in August, 1904.

The accompanying illustration will give some idea as to the character and extent of the skin lesions in August of last year. The patient could move only with considerable pain. The complexion was sallow and the blood, as evidenced by the colour of the lips and conjunctivæ, was deficient in hæmoglobin. Contrary to what one would have anticipated there was no evidence of lardaceous disease and the lungs, kidneys, and other organs appeared to be healthy. In no situation were the lymphatic glands markedly enlarged. It is not necessary to give a minute description of the condition of the skin. Many of the ulcers were deep and their bases where visible were seen to be irregular, yellow, and unhealthy. They were in varying degrees of inflammatory



activity, with thin, ragged, undermined edges, and exuding thin, dirty-white pus. Some, which had entered into a quiescent state, were filled with yellowish-white grumous material. Between the skin and the bone over the shin of the right leg were several soft, semi-fluctuant tumours. On the back were scars indicating that in these situations the process of repair had been successful. With the presence of sinuses and numerous bunches of flabby, unhealthy granulations the character of the lesions, which was the same in all the localities affected, presented a complete clinical picture of tuberculous ulceration of the skin and connective tissues.

When the question of treatment came to be considered it appeared that the only possible chance of success was by means of radical surgical measures. Abscesses should be opened, fungating granulations and ulcers scraped, undermined skin cut away, and sinuses freely laid open. This would have required a series of operations under anaesthesia, which would have proved no light matter in a subject 61 years of age, exhausted by prolonged illness. This line of treatment, which was advised, was not, however, adopted as the patient was not willing to submit himself to further surgical interference. Accordingly he was kept at rest in bed and his constitution was strengthened by an abundance of good food, combined with cod-liver oil, syrup of iodide of iron in full doses, and other tonics. The ulceration of the skin was treated on ordinary antiseptic lines by means of poultices, fomentations, and dusting powder as each in turn seemed to be indicated. The arms and legs were placed in a bath for one hour daily containing lotions, carbolic acid and chinosol, perchloride and biniodide of mercury being the antiseptics used. I found that Fairchild's enzymol was of special service in clearing away dead material in deep ulcers. Salicylic cream (acidi salicylici, two parts; acidi carbolici, one part; glycerine, ten parts) also proved useful. For dusting powder I made use of equal parts of iodoform and dermatol. On one occasion with the aid of local anaesthesia I incised one of the semi-fluctuant tumours over the shin, to which reference has already been made, and found it to contain

